A QUASILINEAR PARABOLIC TYPE VARIATIONAL SOLUTION FOR FOURIER'S IRREVERSIBLE HEAT CONDUCTION PROCESS WITH MINIMUM PRINCIPLES IN CASE OF FINITE SIGNAL RATE

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Abstract

The linear parabolic type PDE for heat conduction process is analyzed. It is an old well-known problem that with constant phenomenological coefficient the signal spreading velocity is infinite for the Fourier heat conduction process. Here is shown a quasilinear solution for this problem with finite signal rate. Connecting to parabolic PDE it is shown the minimum principle solution of Onsager, Prigogine and Gyarmati type for the Fourier irreversible heat conduction process in energy and entropy representation pictures too. For the stationary state of irreversible heat conduction process there is interesting form for the variational minimum solution with the aid of the so-called "naive" variational procedure. This procedure is equivalent with the Euler-Lagrange PDE. So the minimum entropy production or the minimum information loss can be shown with a more general way. As to the phenomenological solutions of quasilinear heat conduction irreversible process the least dissipation of energy in stationary state leads to the different materials in solid state physics, namely to phonon heat conduction(dielectrics and semiconductors with Umklapp processes) and the conductive electrons (in metals) for which heat conduction coefficients variate in hyperbolic way depending on the temperature. Solutions for them are subharmonic type.